PROPELLER TEARDOWN REPORT

Date: February 8/9, 2000

Location: Honeywell/ Allied Signal
Phoenix, AZ

Propeller Model: HC-B4TN-5/T10282-5.3R

Type Aircraft: Mitsubishi MU-2B-26A

Date of Accident: January 22, 2000

Representatives:

Tom McCreary	Hartzell Propeller Inc.
Jason Ragogna	NTSB Ft. Worth
Georgia Snyder	NTSB Ft. Worth
Ralph Sorrells	Mitsubishi
Dave Chapel	Allied Signal

General Comments:

The aircraft was reported:

airspeed: slow, immediately after take-off
attitude: inverted, right wing down
object strikes: impact on hard ground

In the "as received" condition, the spinner dome was missing from both propellers.

Left propeller – All four blades had been removed from the hub (for shipment). The piston/cylinder assembly had separated from the hub due to impact. The left propeller separated from the engine at impact. One blade from the left propeller separated from the hub (clamp broken).

Right propeller - The right propeller remained attached to the engine flange. Two blades had separated from the hub, one clamp was fractured in half. The other clamp had split open.

Most parts showed mild fire damage – blackened, melted rubber, a portion of the right hub had melted cadmium.

This type propeller is a 4-bladed single acting, hydraulically operated constant speed model with full feathering and reversing capabilities. Oil pressure from the primary propeller governor is used to move the blades to the low pitch (blade angle) direction. Blade mounted counterweights and feathering springs actuate the blades towards the high pitch direction in the absence of governor oil pressure. The propellers incorporate a start lock mechanism that holds the blades at a low blade angel during engine start. The blades are of aluminum construction. The hub and blade clamps are steel. Propeller rotation is counterclockwise as viewed from the rear.

Installation Data: (Data reference the 30 inch station)

Flight idle:	12.0	± 0.1	degrees
Reverse:	-6.5	± 0.5	degrees
Feather:	87.5	± 0.5	degrees

Service History:

	S/N	Date of manufacture	TTSN	TSO
Left Hub	CDA3581	5/17/96	unknown	unknown
Blades	H47402	5/11/92		
	H47466	5/11/92		
	unknown			
	H47485	5/11/92		
Right Hub	CDA 3582	5/17/96	unknown	unknown
Blades	H48215	6/5/92		
	H48220	6/5/92		
	H48202	6/5/92		
	H48209	6/5/92		

Last overhaul:

date	organization
5/8/98	Helices Clerici, Buenos Aires, Argentina

Propeller Position: LEFT

Hub Serial Number: CDA3581 **Factory No.:** A8051A

Blade Model:

S/N	LA:	H47402
S/N	LB:	H47466
S/N	LC:	unreadable
S/N	LD:	H47485

Blade Orientation:

LA, LD, LC, LB clockwise as viewed from the rear of the propeller. The hub serial number was between the LC and LB blades.

Spinner Dome:

Missing.

Spinner Bulkhead:

The spinner dome was dented but otherwise unremarkable.

Propeller Cycling:

Not possible.

Engine/Propeller Mounting:

The propeller had separated from the engine flange. The engine flange was broken into two pieces. Three propeller mounting bolts remained attached to the engine flange. The other five bolts had been stripped out and were missing.

Blade/Clamp Rotation:

Blade/clamp rotation at impact is unknown. The blades had been disassembled prior to receipt.

Pitch Change Mechanism:

Feather Stops:

Intact and unremarkable.

Reverse Stops:

Intact and unremarkable.

Piston:

The piston was broken into three pieces. There were three impact marks on the inside of the piston caused by contact with the forward end of the cylinder. One mark was 2-19/32 inch from the end of the piston, another mark 3-13/32 inches, and another mark at 3-27/32 inches. These marks correspond to blade angles of: 32.5°, 58.5°, 72.5° respectively.

Link Arms:

The link arm from blade LD was severely bent, wrapped around the bottom side of the blade counterweight.

The other three link arms remained attached to the piston. One had been bent around the bottom side of the counterweight. The other two had milder bends. All three had elongated link screw holes (indicates tensile load at impact).

Cylinder:

The cylinder had severe impact damage and had separated from the hub

Feathering Spring Assembly:

The rear spring retainer had dislodged and was missing. The spring had extended and had to be cut in half for disassembly.

Support Sleeve Broken (Y/N): yes

Pitch Change Rod: (s/n 270)

The pitch change rod was bent. It had to be cut in half for disassembly.

Start Locks:

All four start locks were intact and unremarkable. They had freedom of movement, operable, and there was no damage to the plates on the blade clamps.

Clamps and Counterweights:

Clamps LA, LB, and LC were intact and unremarkable except that the link screw had been torn out in the direction of high pitch.
Clamp LD had been broken in half.

Clamp serial numbers:

LA:	EG815
LB:	EG838
LC:	EG845
LD:	unknown

Hub Unit:

5 of the 8 mounting bolts had stripped threads out of the hub. The cylinder had separated and the cylinder attaching threads were damaged. The blade pilot tube from blade LD was broken, the fractured section remained in the blade butt.

The hub had two impression marks caused by contact with the blade butts.

Blade LC transferred the characters "PC" onto the hub. When aligned, the general location was roughly 180° from the normal operating position.

Blade LD transferred the character "7" onto the hub. This correlated to a blade angle of approximately 39.5°.

Blades:

There was fire damage to all of the blades.

Blade LA was lightly bent aft at mid-blade. There was a dent on the trailing edge about 10 inches from the tip. There was a 2-inch tear in the leading edge, about 5 inches from the tip. There was leading edge damage on the outer 1/3 of the blade.

Blade LB had severe leading edge nicks in the outer 1/3 of the blade (photo 1, 2). The outer 4 inches of the tip was torn off and bent into a "U" shape. There was rotational score marks in the paint on the flat side. There was "S" bending, bent aft at mid-blade, bent forward at the tip.

Blade LC had severe leading edge nicks and tears in the outer ¼ of the blade (photo 3). It had dents in the trailing edge in the outer ½ of the blade. There were numerous scratches in the paint on the flat side of the blade.

Blade LD was bent forward at 1/3 radius. There were large dents/tears on the leading edge on the outer 1/3 of the blade. There were scratches and rotational scoring in the paint on the camber side (photo 4, 5, 6).

Propeller Position: RIGHT

Hub Serial Number: CDA3582 **Factory No.:** A8046A

Blade Model: LT10282-5.3R

RA	S/N:	H48202
RB	S/N:	H48220
RC	S/N:	H48215
RD	S/N:	H48209

Blade Orientation:

RA-RD-RC-RB clockwise as viewed from the rear of the propeller. The hub serial number was between the RA and RB blades.

Spinner Dome:

Missing

Spinner Bulkhead:

Dented, unremarkable.

Propeller Cycling:

Not possible.

Engine/Propeller Mounting:

Intact and unremarkable (photo 7).

Blade/Clamp Rotation:

Unknown - Blade RC had separated at impact. Other blades had been removed from the clamp prior to inspection.

Pitch Change Mechanism:

Feather Stops:

Intact and unremarkable.

Reverse Stops:

Intact and unremarkable.

Piston:

There was an impact mark on the inside of the piston caused by contact with the forward end of the cylinder (photo 13, 16, 17, 18). The mark was 2-15/32 inch from the end of the piston. This mark corresponds to blade angle of 28.5°.

Link Arms:

See photos 16, 20-28.
RD was bent, twisted, and had an elongated link screw hole.
RA was severely bent and was wrapped around the bottom side of the blade counterweight.
RB was slightly bent and had an elongated linkscrew hole
RC was slightly bent

Cylinder:

The cylinder had separated from the hub and had a large dent near the hub attachment. The dent was caused by impact with a blade clamp (photo 15).

Feathering Spring Assembly:

The rear spring retainer had been disengaged and was missing. The pitch change rod was bent. The Beta tube was bent. (The damage was consistent with the cylinder/piston assembly having been broken free from the hub.)

Support Sleeve Broken (Y/N): Yes

Pitch Change Rod: (S/N: 281)

The pitch change rod was bent, but otherwise unremarkable.

Start Locks:

All four start locks were intact and unremarkable (photo 14). They had freedom of movement, operable, and there was no damage to the plates on the blade clamps.

Clamps and Counterweights:

See photos 20-28.
Clamp RA and RD could not be identified as to which blade they had been installed on.
Clamps RA and RD were intact except the counterweights and weight slugs had been broken off.
Clamp RB was fractured in half.
Clamp RC was split open. It had two broken bolts on one side and two bent bolts on the opposite side. The counterweight was broken off.

Clamp serial numbers:

RA/D?:	EG1859
RB:	EG1886
RC:	EG1874
RA/D?:	EG1869

Hub Unit:

The mounting flange was intact and unremarkable.
The cylinder attachment threads were damaged (cylinder had separated from hub).
Two blade pilot tubes had broken (from blades RB and RC) (photos 7-12).

Impression marks from blade butts:

Blade RC had an impression stamp that transferred onto the hub arm. Alignment of these marks indicated a blade angle of 27.5° at the time the mark was created.

Blade RB had broad score mark that transferred onto the hub arm. Alignment of these marks indicated a blade angle range from 12.0° to 30.0° (21.0° average) at the time the marks were created.

Blades:

Blade RA had a very mild forward bend (10°-20°) at mid-blade. It had very little paint damage. Fire damage (photo 33, 34).

Blade RB had separated from the hub (clamp broke in half). It was fire damaged and had rotational scoring on the camber side. It had scratches (non-rotational) in the paint on the flat side. It was bent slightly forward at 1/3 radius and was twisted toward low pitch (photo 35, 36).

Blade RC had separated from the clamp. It was bent aft about 45°. The blade shank was split in half. There was a deep gouge in the leading edge about mid-blade. It had scratches (non-rotational) in the paint on the camber side (photo 37, 38).

Blade RD had a very mild forward bend (10°-20°) at mid-blade. It had very little paint damage. It had a gouge on the trailing edge about 12 inches from the butt. Fire damage (photo 39, 40).